PATENT
Docket No. 127099-1
(HDP# 8564-000031/US)

IN THE U.S. PATENT AND TRADEMARK OFFICE

Applicant:	Lukas TROSMAN, et al.	Conf.: 5555
Appl. No.:	10/748,174	Group: 3663
Filed:	December 31, 2003	Exr: Johannes P. MONDT
For:	DISTRIBUTED CLUMPING OF PART-LENGTH RODS FOR A REACTOR FUEL BUNDLE	

REPLY TO NOTICE OF NON-COMPLIANCE

Customer Service Window
Randolph Building
401 Dulany Street
Alexandria, VA 22314

January 7, 2010

Sir:

In reply to the Notice of Non-Compliance mailed December 16, 2009, Applicants attach hereto a third corrected Appeal Brief originally filed on February 17, 2009, as requested by the Examiner.

It should be noted that in phone discussions between Applicant's Representative and the Examiner on January 5, 2010, the Examiner indicated that the advanced copy of the corrected Appeal Brief (which was provided to the Examiner via facsimile, and included verbatim in this Response) corrects any defects described in the Examiner's December 16, 2009 Notice of Non-Compliant Appeal Brief. The Examiner also indicated in the January 5, 2009 phone discussions that the period for replying to the December 16, 2009 Notice of Non-Compliant Appeal Brief was one (1) month from the December 16, 2009 issue date of the Notice.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 08-0750 for any additional fee required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

Respectfully submitted,

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Attachments: Copy of Appeal Brief originally filed 02/17/2009.
Copy of Decision dated March 31, 2008 in related case 10/748,175.

PATENT

IN THE U.S. PATENT AND TRADEMARK OFFICE

Applicant:	Lukas TROSMAN et al.
Application No.:	10/748,174
Art Unit:	3663
Conf. No.:	5555
Filed:	December 31, 2003
Examiner:	Johannes P. Mondt
For:	DISTRIBUTED CLUMPING OF PART-LENGTH RODS FOR A REACTOR FUEL BUNDLE
Atty. Dkt. No.:	127099-1 (HDP#8564-000031/US)

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Randolph Building
401 Dulany Street
Alexandria, VA 22313
Mail Stop **Appeal Brief – Patent**

Date: February 17, 2009

APPELLANT'S BRIEF ON APPEAL UNDER 37 C.F.R. §41.37

Sir:

This is an Appeal Brief in response to the Final Office Action mailed November 19, 2008 and the Advisory Action mailed January 27, 2009, pertaining to claims 24, 26-29, and 31-33. This Appeal Brief is being filed concurrently with a Notice of Appeal. Appellant submits herewith their Brief on Appeal as required by 37 C.F.R. §41.37 along with the appropriate governmental fees as required by 37 C.F.R. §41.20(b)(2).

I. REAL PARTY IN INTEREST:

The real party in interest is Global Nuclear Fuel – Americas, LLC as evidenced by the Assignment recorded at Reel 014854 and Frame 0816.

II. RELATED APPEALS AND INTERFERENCES:

A Board of Patent Appeals & Interferences Decision was rendered on March 31, 2008 for related application 10/748,175, which has been referenced in the Evidence Appendix and Related Proceedings Appendix at the end of this document. There are no other prior or currently pending Appeals related to this application.

III. STATUS OF CLAIMS:

Claims 24, 26-29, and 31-33 are pending in this application, with claims 24, 28, and 31 being in independent form. Claims 1-23, 25 and 30 have previously been cancelled. Each of claims 24, 26-29, and 31-33 remain finally rejected and are being appealed.

1. Claims 24 and 26-29 are rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 6,735,267 ("Orii") in view of U.S. Patent No. 5,068,082 ("Ueda") in view of U.S. Patent 5,229,068 ("Johansson");
2. Claims 31-33 are rejected under 35 U.S.C. §103(a) as being unpatentable over Orii in view of Johansson.

Claims 24, 26-29, and 31-33 are being appealed.

IV. STATUS OF AMENDMENTS:

A Request for Reconsideration was filed on July 30, 2008, and entered by the Examiner. A Request for Reconsideration was filed December 12, 2008, and not entered. The Claims Appendix reflects claims 24, 26-29, and 31-33 as listed in the July 30, 2008 submittal.

V. SUMMARY OF CLAIMED SUBJECT MATTER:

The following explains the subject matter set forth in each claim argued on appeal by way of example embodiments in the specification by page and line number, and in the drawings, if any, by reference characters only to satisfy 37 C.F.R. §41.37(c)(1)(v). This concise explanation relies on example embodiments from the specification to describe the claims; however, the claims recite subject matter not limited to these example embodiments. Independent claims 24, 28, and 31 are argued on appeal and discussed below.

Independent Claim 24

Example embodiments of the present invention are related to a fuel rod configuration for a fuel bundle including both part-length and full-length fuel rods. The embodiments provide an extra water volume near the full-length rods, in the voids above the part-length rods, in order to increase neutron absorption (i.e., "trap" extra neutrons) and prevent inadvertent reactor criticality in order to ultimately increase the shut-down margin. The shut-down margin is the margin of trapped neutrons, as compared to fission neutrons, which acts to prevent criticality.

Claim 24 recites "A fuel bundle for a boiling water reactor". As described on page 4, line 19 through page 6, line 4 of the as-filed application, an elevation view

of a fuel bundle 10 is shown in FIG. 1, and a cross-sectional view of a fuel bundle 10 is shown in FIG. 2.

Claim 24 further recites "a generally square, hollow tube having four sides which are configured as sides of the bundle". This reads on page 5, line 15 through page 6, line 4, and FIG. 2 which shows the tube of bundle 10 having a square shape with four side walls 34. As shown in FIG. 2, the tube of bundle 10 is hollow (i.e., the four sided bundle shown in FIG. 2 is open inside, in order to house fuel rods and water passages).

Claim 24 further recites "a pair of circular-shaped water passages located adjacent to a longitudinal centerline of the tube so as to extend centrally through the tube, the pair of water passages supported by one or more rod supports". This reads on page 6, line 17 through page 7, line 10, which describes circularly-shaped water passages 36 adjacent to the centerline 37 which is shown on FIG. 2. As described on page 4, line 19 through page 5, line 6, the water passages 36 are supported by rod supports 22, 24, 26 shown in FIG. 1.

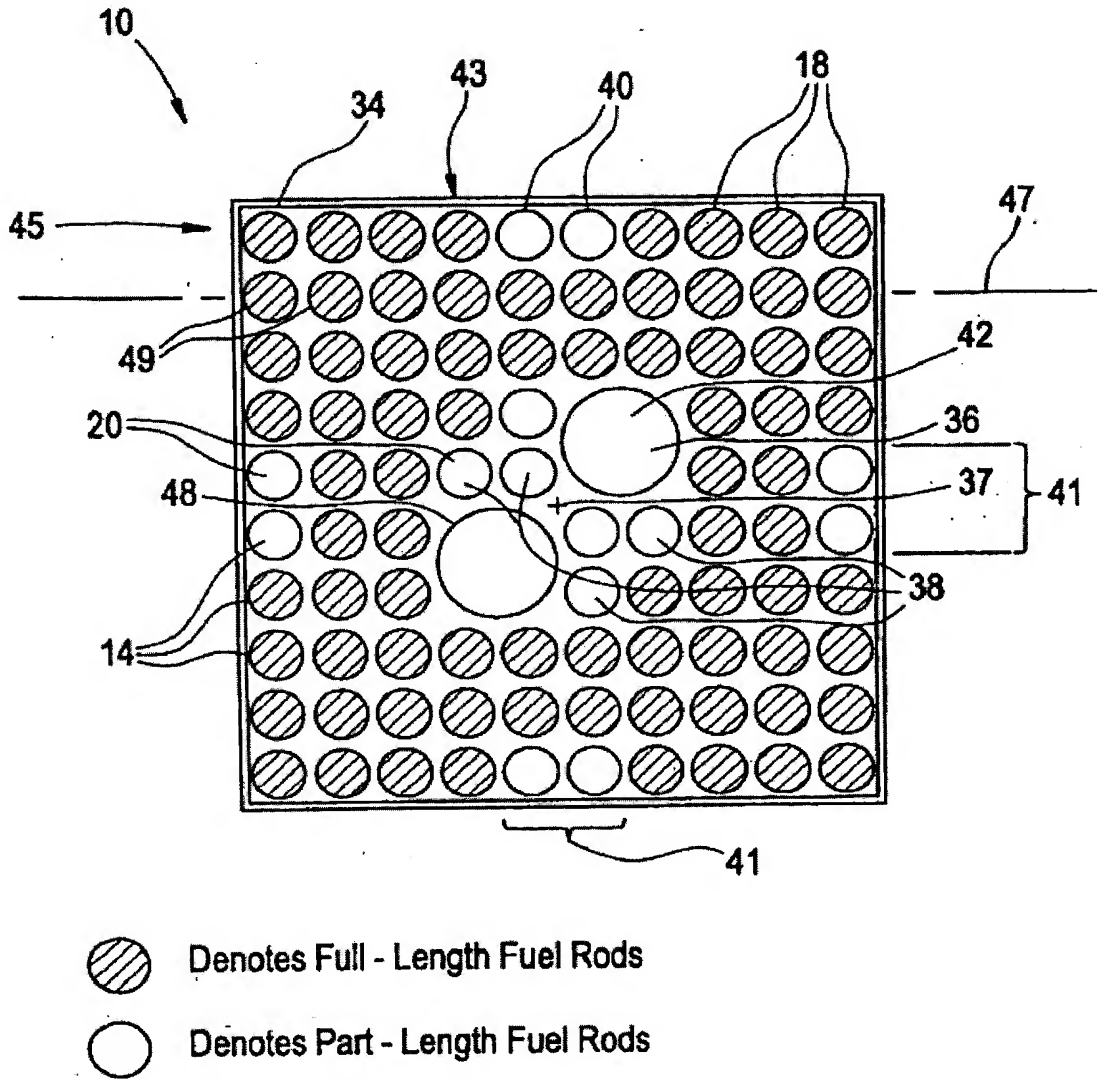
Claim 24 further recites "a plurality of fuel rods arranged in a 10x10 matrix and including full-length rods and part-length rods, the part-length rods further comprising". This reads on page 4, line 19 through page 5, line 6, which describes fuel rods 18, 20 arranged in a 10x10 matrix (FIG. 2) including full-length rods 18 and part-length rods 20.

Claim 24 further recites "a first part-length rod group including two subsets in a mirror-image relationship along the centerline between the two water passages, each subset further comprising three part-length fuel rods in a triangular orientation with one rod of the subset closer to the longitudinal centerline between the two water passages than the other two rods of the subset and directly adjacent to the other two rods of the subset". This reads on page 6, lines 5-16, and FIG. 2

which depicts first part-length rods in two subsets 38 between the water passages 36 with one rod of each subset (see the two center-most rods 38, between the water passages 36) closer to the longitudinal centerline 37.

Claim 24 further recites "a second part-length rod group including four pairs of part-length rods, each part-length rod pair centrally located in the outermost row or column of the 10x10 matrix adjacent a corresponding one of the four sides of the tube". This reads on page 6, lines 5-16, which describes a second part-length rod group of four pairs of part-length rods 41 that are centrally located in the outermost rows or columns 45 adjacent to the sides 34 of the bundle 10.

FIG. 2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41
Denotes Full - Length Fuel Rods
Denotes Part - Length Fuel Rods

Independent Claim 28

Claim 28 recites "A fuel bundle for a boiling water reactor". As described on page 4, line 19 through page 5, line 6 and page 5, line 15 through page 6, line 4, an elevation view of a fuel bundle 10 is shown in FIG. 1, and a cross-sectional view of a fuel bundle 10 is depicted in FIG. 2.

Claim 28 further recites "a pair of centrally located, circular-shaped water passages arranged on either side of a longitudinal centerline of the bundle within a 10X10 fuel-rod matrix bounded by four sides of a generally square, hollow tube, the fuel rods including full-length and part-length fuel rods". This reads on page 5, line 15 through page 6, line 4, which describes a pair of water passages 36 that are depicted in FIG. 2 arranged around a centerline 37 of a generally square tube 10 with full-length 18 and part-length 20 rods. As shown in FIG. 2, and as described on page 7, lines 8-10, the water passages are circular shaped. As shown in FIG. 2, the tube of bundle 10 is hollow (i.e., the four sided bundle shown in FIG. 2 is open inside, in order to house fuel rods and water passages).

Claim 28 further recites "wherein the 10X10 fuel-rod matrix includes two 3-rod subsets consisting of part-length rods in a mirror image relationship with one another along the longitudinal centerline between the two water passages, each 3-rod subset configured in a triangular orientation and directly adjacent to the pair of water passages such that one rod of the 3-rod subset is closer to the centerline than the other two rods and directly adjacent to the other two rods, and comprising eight additional part-length rods arranged in four pairs, each pair centrally located on an outermost row or column of the matrix nearest a corresponding one of the tube sides". This reads on page 6, lines 5-16, which describes the 3-rod subsets 38 of part-length rods 20 along a centerline 37 that are between water passages 36, with one rod (see the two center-most rods 38, between the water passages 36) of

the 3-rod subset 38 closer to the centerline 37. As described on page 6, lines 5-16, the eight additional part-length rods 20 are arranged in pairs 41 which are centrally located on the outermost rows or columns 45 near the tube sides 34.

As described on page 6, line 17 through page 7, line 10, the arrangement in FIG. 2, (as recited in either claims 24 or 28) may potentially increase an overall neutron absorption rate using the two part-length rod groups in the particular orientation. This arrangement may provide improved shutdown margin for a boiling water reactor by locally increasing the size of the water traps or voids that are above the part-length fuel rods.

Independent Claim 31

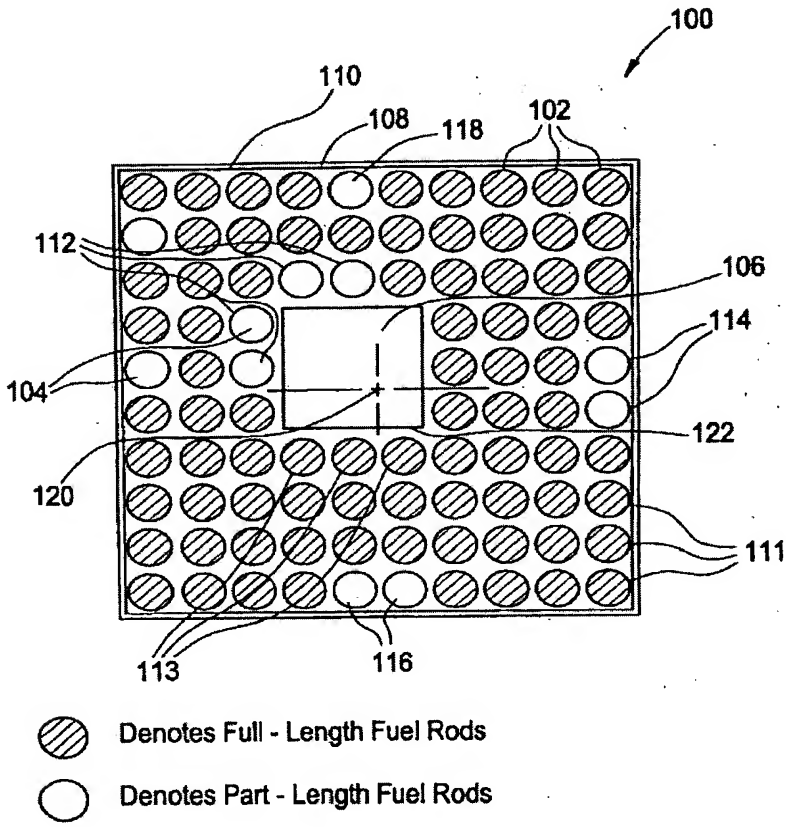
Claim 31 recites "A fuel bundle for a boiling water reactor". As described on page 4, line 19 through page 5, line 6 and page 7, lines 11-21, an elevation view of a fuel bundle 10 is shown in FIG. 1, and a cross-sectional view of a fuel bundle 100 is depicted in FIG. 3.

Claim 31 further recites "a single, square-shaped water passage located off-center within a 10x10 fuel-rod matrix bounded by four sides of a generally square, hollow tube, the fuel rods including full-length and part-length fuel rods". This reads on page 7, lines 11-21, which describes the single, square-shaped water passage 106 that are located off of center 120 within a 10x10 matrix (FIG. 3) with four sides 110 of the bundle 100, the bundle 100 including full-length 102 and part-length 104 rods. As shown in FIG. 3, the tube of fuel bundle 110 is hollow (i.e., the four sided bundle shown in FIG. 3 is open inside, in order to house fuels rods and a water passage).

Claim 31 further recites "wherein the 10X10 fuel-rod matrix includes a first rod group comprising two pairs of part-length rods arranged on either side of a

corner of the square water-passage, and a second rod group comprising two pairs of part-length rods and at least two non-paired part-length rods, each of the two pairs and the at least two non-paired part-length rods located in a corresponding outermost row or column of the matrix adjacent a corresponding side of the tube". This reads on page 7, line 22 through page 8, line 10, and FIG. 3 which shows the 10x10 matrix that includes first rod groups 112 of part-length rods on either side of a corner of the water passage 106. As described on page 7, line 22 through page 8, line 10, FIG. 3 also depicts the second rod groups of two pairs of part-length rods 114, 116 and two non-paired part-length rods 118 located in the outermost rows or columns (see the 26 rods located around the perimeter of the matrix) along the tube side walls 110.

FIG. 3



VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Rejection of claims 24 and 26-29 under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 6,735,267 ("Orii") in view of U.S. Patent No. 5,068,082 ("Ueda") in view of U.S. Patent 5,229,068 ("Johansson").

Rejection of claims 31-33 under 35 U.S.C. §103(a) as being unpatentable over Orii in view of Johansson.

VII. ARGUMENT

Claims 24 and 26-29 rise and fall together.

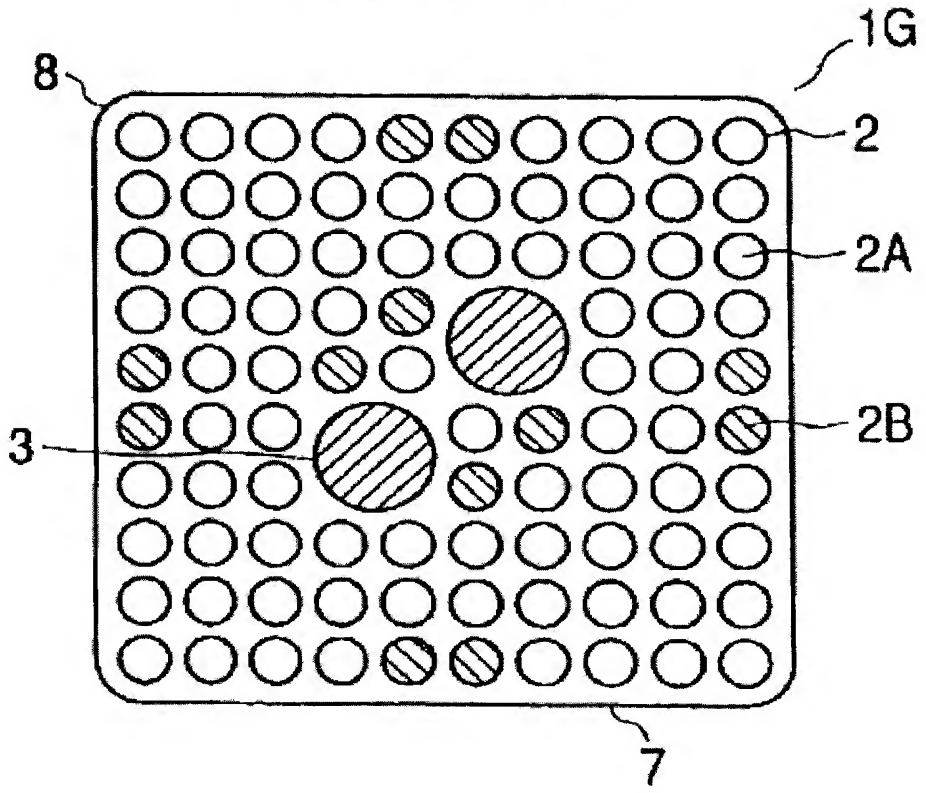
Claims 31-33 rise and fall together.

A. Claims 24 and 26-29 are not rendered obvious under 35 U.S.C. §103(a) as being unpatentable over Orii in view of Ueda in view of Johansson.

The Examiner rejects claims 24 and 26-29 as being unpatentable over Orii et al. ("Orii") in view of Ueda et al. ("Ueda") and further in view of Johansson et al. ("Johansson"). The Examiner asserts that Orii teaches the basic inventive concept of independent claims 24 and 28 including a generally square fuel bundle having a pair of water passages with circular cross-sections located centrally or proximal center, a first part-length rod group including two pair of part-length fuel rod subsets in a mirror-image along the centerline located between the two water passages and a second part-length rod group including four pair of part-length rods located in the outermost rows of a 10x10 matrix adjacent to one of the four sides of the tube. The Examiner relies on FIG. 15 of Orii (shown below), in making this assertion[1].

[1] See page 4, of the December 20, 2006 Office Action.

FIG. 15



The Examiner cites Ueda, FIG. 19 (see figure below) and col. 12, lines 53-66, asserting that Ueda indicates that it is well-known in the art to provide certain groupings of part-length rods, and in particular 3-rod subgroups adjacent to a water passage[2]. The Examiner cites col. 2, lines 3-15 of Johansson[3], asserting that Johansson teaches that the addition of part length rods lowers the pressure drop and thereby improves the critical power of a fuel bundle. The Examiner asserts that the inclusion of a third rod in Orii is no more than the duplication of parts with predictable and intended effects, and the conditional Equations of Orii allow

[2] See page 4, of the December 20, 2006 Office Action.
[3] See page 6, of the December 20, 2006 Office Action.

for a "broad continuum of parameter values as acceptable solutions for Orii's stated purpose."[4]

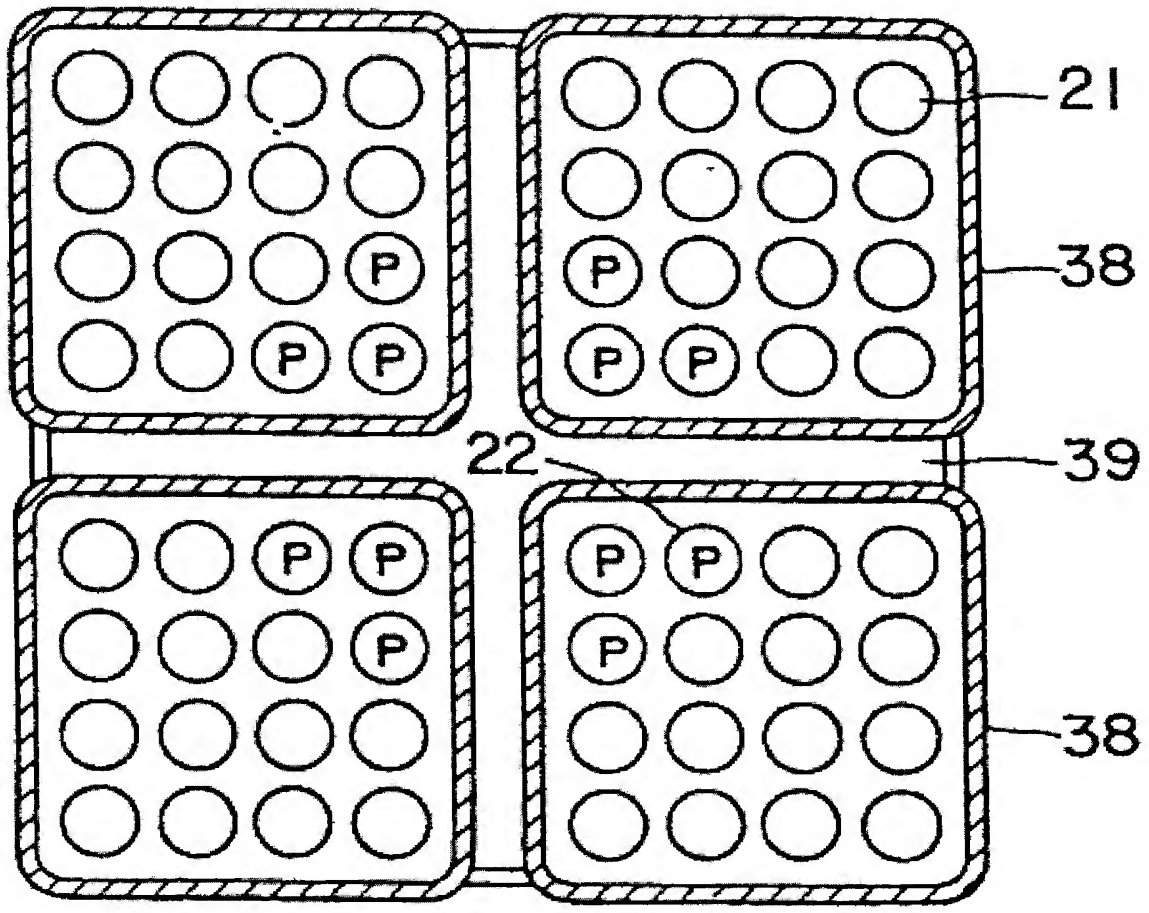


FIG. 19

With regard to Orii, Appellant submits that Orii discloses specific conditional Equations (see the conditional Equations 1-6) that are used to determine acceptable orientations for full-length and part-length rod patterns in a fuel assembly. The primary objective of Orii's conditional Equations is *to provide rod*

[4] See page 3 of the January 27, 2009 Advisory Action.

patterns that increase burn-up without increasing pressure loss, as stated in at least column 1, lines 54-58. Orii's conditional Equations involve several parameters including total horizontal sectional area of water rods (Awr), horizontal sectional area of a coolant flow passage in a bottom portion of the fuel assembly (Ach), effective fuel length of the full-length fuel rods (Lf), effective fuel length of the part-length fuel rods (Lp), number of part-length rods (n), and average burn-up (GWd/t), which are used to arrive at acceptable fuel rod orientations. Orii uses Equations 1-6 as a starting point, and includes additional conditional Equations that are specific to each of *6 distinct embodiments disclosed by Orii*. The 6 distinct embodiments are summarized, below.

Embodiment 1: Pertaining to FIGS. 2 and 8.
Embodiment 2: Pertaining to FIGS. 9 and 11.
Embodiment 3: Pertaining to FIGS. 12 and 14.
Embodiment 4: Pertaining to FIGS. 15 and 17.
Embodiment 5: Pertaining to FIGS. 18 and 20.
Embodiment 6: Pertaining to FIGS. 21 and 23.

The Examiner concedes[5] that Orii does not teach part-length rod groups that include two groups of "*three part-length fuel rods in triangular orientation* with one rod of the subset closer to the longitudinal centerline between the two water passages than the other two rods of the subset," as recited in independent claim 24. The Examiner asserts that it would have been obvious for a person of ordinary skill in the art to modify the fuel rod orientation of FIG. 15 of Orii ("embodiment 4" of Orii) by adding additional part-length rods, thus providing 3-rod groups of part-length fuel rods as disclosed in Ueda.[6] Appellant asserts that Orii's specific fuel rod patterns, shown in FIGS. 2-23, were discovered through the rigorous application of Orii's conditional Equations, and **significant calculations and additional**

[5] See page 4 of the December 20, 2006 Office Action.
[6] See Pages 4 and 5 of the December 20, 2006 Office Action.

experimentation would be required to further modify Orii's fuel rod patterns while ensuring that Orii's Equations remain satisfied. Specifically with regard to "Embodiment 4", column 13, line 12 through column 14, line 16 of Orii describes considerations that were included in arriving at the exact fuel rod patterns shown in FIGS. 15 and 17. Some of these considerations are provided below.

> "In the present embodiment, because all the short length fuel rods 2B are arranged at the positions where the effect of improving the void coefficient is large, that is, at the positions in the outermost tier... the condition for the core stability, that is, Equation 15 is different from the condition for the core stability in Embodiment 1..."[7]
>
> "By arranging the short length fuel rods 2B in the outer-most tier, the void coefficient is reduced to more than one half as small as that in the case where the short length fuel rods 2B are arranged in the second tier of the fuel rod array from the outer side."[8]
>
> "However, in the case where the short length fuel rods 2B are arranged at the corners of the outermost tier, both of the reactivity loss and the local power peaking factor of the short length fuel rods arranged at the corners become large. Therefore, arranging of the short length fuel rods 2B at the corners should be avoided."[9]
>
> "Further, by arranging the short length fuel rods at the positions in the outermost tier... the reactivity loss and the local power peaking can be reduced."[10]
>
> The discussion of "Embodiment 4" concludes by stating the following.
>
> "The short length fuel rods may be arranged differently from the arrangement of FIG. 15 if the short length fuel rods are arranged both in the positions in the outermost tier and in the positions adjacent to the water rods, or arranged only in the outermost tier, and further the fuel assembly 1H shown in FIG. 17 may be acceptable."[11]

Appellant submits that Orii's "Embodiment 4" calculations (involving conditional Equations 1, 3, 4, 6, 11, and 15) culminate in the graphical

[7] See column 13, lines 21-27.
[8] See column 13, lines 49-53 of Orii.
[9] See column 13, lines 55-61.
[10] See column 13, line 63 through column 14, line 2.
[11] See column 14, lines 7-12.

representation shown in FIG. 16, where the "hatched" area of the figure represents acceptable fuel rod patterns that meet each of Orii's conditional Equations. As described in column 12, line 54 through column 14, line 16. FIGS. 15 and 17 represent two specific "Embodiment 4" fuel rod patterns that reside within the "hatched" area of FIG. 16. Appellant asserts that **the Examiner's suggested modification of FIG. 15 improperly replaces rigorous calculations and experimentation using Orii's conditional Equations with mere speculation as to how the specifically derived fuel rod pattern of FIG. 15 may be further modified**. Appellant asserts that Orii's FIG. 15 embodiment appears to be similar to the fuel rod pattern recited in independent claim 24 by a product of nothing more than coincidence, as Orii's conditional Equations are focused on *increasing burn-up without increasing pressure loss*. Appellant asserts that Orii does not teach or suggest a part-length rod pattern for improving reactor shutdown margin, and the Examiner points to no portion of Orii that discusses this attribute. Therefore, Appellant asserts that Orii does not freely allow for a "*broad continuum* of parameter values as acceptable solutions",[12] as asserted by the Examiner, without first enduring significant experimentation in assuring that all of Orii's conditional Equations are met. Appellant therefore asserts that it would not have been obvious for a person of ordinary skill in the art to have modified the derived fuel rod pattern of FIG. 15 of Orii in the manner asserted by the Examiner.

With respect to Ueda, the Examiner's citation to FIG. 19 and col. 12, lines 53-66 of Ueda[13] is simply a general reference to 3-rod subgroups near water passages, where the 3-rod subgroups are full-length "interposed" rods (as shown in at least FIGS. 2A and 59A) filled with a significantly reduced level of fissile material

[12] See Page 3 of the January 27, 2009 Advisory Action.
[13] See page 4, of the December 20, 2006 Office Action.

in at least a portion of the fuel rod. As explained in the Abstract, Ueda also teaches embodiments using shorter-length rods (as shown for instance in FIGS. 21A, 22A, 25A and 57A). However, the specification and figures of Ueda indicate that the embodiment of FIG. 19 is an embodiment using full-length "interposed" rods 22, and not part-length rods (see description in col. 12, lines 53-66). While other embodiments such as FIG. 25A of Ueda do use part-length rods, the FIG. 19 embodiment is specific to only "interposed" rods. It should be noted that the Examiner has cited column 8, lines 20-48 in expressly asserting that Ueda discloses part-length rods,[14] but the Examiner misunderstands column 8, lines 20-48 which discloses an "interposed member" 27 that is less than 1/3 of the entire length of the rod (i.e., the "interposed" insert 27, shown in at least FIG. 2A, has a length that is less than 1/3 of the overall height "H" of the rod). Therefore, Appellant asserts that FIG. 19 suggests no more than the use of full-length 3-group rods 22, consisting of fissile-material that differs from conventional rods, which may be located near a water passage. Further, the FIG. 19 water passage is cruciform-shaped, and not "a pair of circular-shaped water passages", as recited in claim 24, making the relevance of FIG. 19 more attenuated. Additionally, the 3-rod groups in FIG. 19 are not "two subsets in a mirror-image relationship... between the two water passages", as recited in claim 24, as they are instead four 3-rod subgroups. Lastly, Ueda's FIG. 19 involves an 8x8 matrix, which differs from the "10x10 matrix" recited in Applicant's claim 24. While the Examiner has explained that Ueda is not being cited in order to teach the precise part-length rod orientation of claim 24, Appellant asserts that the part-length rod orientation of FIG. 19 differs so significantly from claim 24 (with a very different water passage orientation, twice the number of 3-rod subgroups, and an 8x8 matrix as opposed to 10x10) that Ueda

[14] See page 3 of the January 27, 2009 Advisory Action.

provides almost no guidance for a person of ordinary skill in the art to modify FIG. 15 of Orii. Furthermore, because FIG. 19 is teaching the use of full-length "interposed" rods, contrary to the Examiner's explicit assertion that FIG. 19 discloses part-length rods,[15] Appellant asserts that FIG. 19 is altogether inapplicable to claim 24 and the orientation of "*part-length*" rod groups.

The Examiner cites FIG. 25A of Ueda[16] in order to support the assertion that Ueda teaches the use of 3-rod subgroups of part-length rods. While Appellant does agree that FIG. 25A discloses the use of part-length rods (unlike FIG. 19, which expressly discloses only "interposed" rods, using "interposed" sections that are less than 1/3 the length of a normal fuel rod), Appellant draws the Examiner's attention to FIGS. 25B, 25C and 25D which are cross-sectional views at various elevations of FIG. 25A (as explained in col. 14, lines 41-46). It is clear from FIGS. 25B, 25C and 25D that the cruciform orientation of the 16 part-length rods depicted in FIGS. 25A – 25D provides no reasonable relevance to the teaching or suggestion of "three part-length fuel rod" subgroups, as recited in Applicant's claim 24.

Assuming, *arguendo*, that Orii could be combined with Ueda (Appellant does not admit or even believe that these references may be combined), the combination of these references would still not teach claim 24, as neither of these references teach "a first part-length rod group including two subsets in a mirror-image relationship along the centerline between the two water passages, each subset further comprising three part-length fuel rods in a triangular orientation with one rod of the subset closer to the longitudinal centerline between the two water passages than the other two rods of the subset," as recited in claim 24.

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[15] See Page 3 of the January 27, 2009 Advisory Action.
[16] See page 5 of the December 20, 2006 Office Action.

Additionally, Appellant asserts that it is improper to combine Orii with Ueda, in the manner asserted by the Examiner. A combination of references that destroys the intended function of one of the references, is not proper[17]. Orii places great emphasis on the satisfaction of conditional Equations to arrive at specifically derived part-length rod orientations, the orientations focused on *increasing burn-up without increasing pressure loss*. The combination of Orii with a reference that may suggest the use of 3-rod groups rather than 2-rod groups[18], or the combination of Orii with a reference that may suggest the benefits of part-length rods[19], generally, is in essence destroying the specific teachings of Orii. Specifically, the Examiner disregards the extent of experimentation described by Orii (see column 12, line 54 through column 14, line 16, describing the considerations included in "Embodiment 4," to arrive at the specific FIG. 15 orientation) in ensuring that each part-length rod orientation of Orii meets the set of conditional Equations disclosed in the Orii abstract. Appellant asserts that such casual manipulation of Orii's rigorously defined part-length rod orientations, using only the general teachings of Ueda, renders the Orii reference inoperable for its intended purpose. For at least these reasons, Appellant asserts that the combination of Orii and Ueda, as asserted stated by the Examiner, is improper under 35 U.S.C. §103.

With respect to Johansson, the Examiner cites col. 2, lines 3-15 in making the assertion that Johansson teaches the addition of part-length rods which lower pressure drop and improve critical power[20]. Appellant asserts that the addition of Johansson's with the Orii and Ueda combination also causes Orii to be inoperable for its intended purpose. The Examiner's suggested combination of Johansson

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[17] In re Gordon, 733 F.2d 900, 902 (Fed. Cir. 1984).
[18] See the Examiner's assertion in introducing Ueda, on page 4 of the December 20, 2006 Office Action.
[19] See the Examiner's assertion in introducing Johansson, on page 5 of the December 20, 2006 Office Action.
[20] See Page 5 of the December 20, 2006 Office Action.

with Orii and Ueda would violate the conditional Equations of Orii. As such, combining Johansson with Orii and Ueda would destroy Orii for its intended purpose. This is an impermissible and non-obvious combination, and therefore claim 24 cannot be rendered obvious to a person of ordinary skill in the art.

In combining the teachings of Ueda and Johansson with Orii, the Examiner has argued that inclusion of a third part-length rod in the Orii configuration is "no more than the duplication of parts with predictable and intended effects."[21] Appellant again draw the Examiner's attention to col. 13, lines 5-11 of Orii, which explain that the derived configuration of Orii's FIG. 15 embodiment satisfies Equations 1, 3, 4, 6, 11, and 15. As explained in col. 13, lines 43-45, the ratio of part-length rods to full-length rods is just one of the carefully selected attributes of FIG. 15. Orii continues, by explaining that the FIG. 15 embodiment may be in essence duplicated, with a similar embodiment as shown in FIG. 17 and discussed in col. 14, lines 7-16. Orii is clear that the precise positions of the part-length rods in FIG. 17, similar to FIG. 15, need to be arranged just as depicted in FIG. 17 (col. 14, lines 7-16). It should be noted that neither the specifically arranged part-length rod pattern of FIGS. 15, nor FIG. 17, teach Applicant's claim 24. Orii continues to teach other part-length rod orientations, for instance those shown in FIGS. 18 and 20 (and discussed in col. 14, lines 18-52 and col. 15, lines 23-34), neither of which teach Applicant's claim 24. In each case discussed above, Orii specifies that the conditional Equations must be met in order to provide for the specific embodiments depicted in the figures. At no time does Orii suggest that other similar orientations involving part-length rods may be overtly manipulated or attempted, such that a skilled artisan would be motivated to openly experiment with placing more (or less) part-length rods within orientations already depicted

[21] See page 4 of the December 20, 2006 Office Action.

within the provided figures. Orii places great emphasis on all rod orientations meeting the conditional Equations listed in the Abstract and discussed throughout the reference. For at least these reasons, it is apparent that simply adding (or subtracting) more part-length rods to Orii's FIG. 15 would not be merely duplicating parts with a predictable and intended effect, but instead would disrupt the specifically derived orientation of part-length rods that meet the particular conditional Equations taught by Orii.

With regards to independent claim 28, the same arguments can be made against the cited art which does not teach either singly, or in combination, "*two 3-rod subsets* consisting of part-length rods in a mirror image relationship with one another along the longitudinal centerline between the two water passages, each 3-rod subset configured in a triangular orientation and directly adjacent to the pair of water passages".

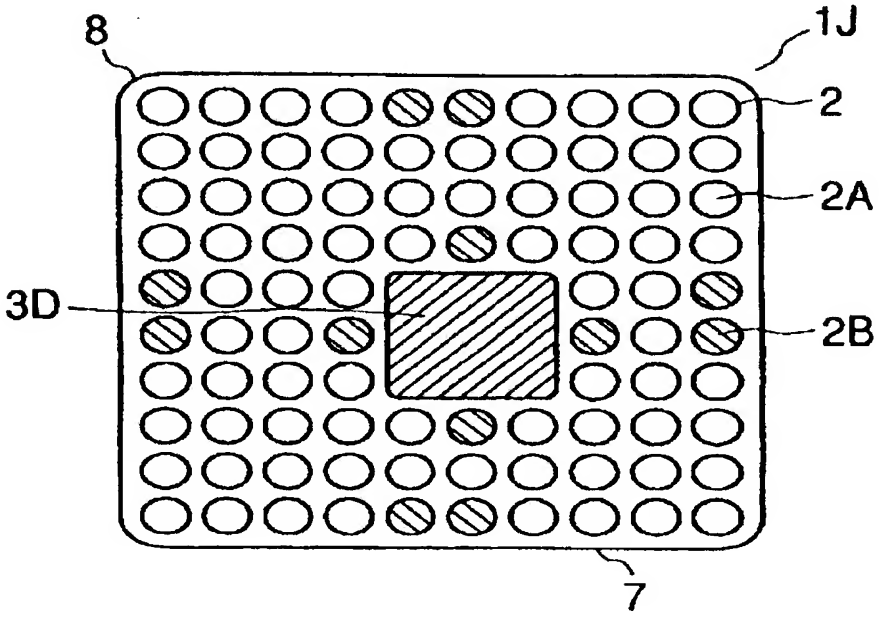
For at least the reasons stated above, Appellant asserts that independent claims 24 and 28 are patentable. Due at least to the dependence of claims 26-27 and 29 on independent claims 24 and 28, Appellant asserts that these claims are also patentable. Therefore, Appellant respectfully requests that the Board reverse the Examiner's rejection of these claims.

B. Claims 31-33 are not rendered obvious under 35 U.S.C. §103(a) as being unpatentable over Orii in view of Johansson.

The Examiner rejects claims 31-33 as being unpatentable over Orii et al. ("Orii") in view of Johansson et al. ("Johansson"). The Examiner points to Orii as the primary reference cited against these claims (see FIG. 20, below). The Examiner asserts that Johansson teaches that "the addition of part length rods

lowers the pressure drop, thereby improving critical power,"[22] which the Examiner explains provides the requisite motivation for a skilled artisan to modify Orii's orientation such that two of the pairs of part-length rods near the tube sides may become lone part-length rods (rather than a pair of rods), and the four part-length rods on each side of the water passage may become two pairs, located on a corner of the water passage.

FIG. 20



Appellant asserts that neither Orii or Johansson, either singly or in combination with each other, teach or suggest "a first rod group comprising two pairs of part-length rods arranged on either side of a corner of the square water-passage, and a second rod group comprising two pairs of part-length rods and at least two non-paired part-length rods, each of the two pairs and the at least two non-paired part-length rods located in a corresponding outermost row or column of

[22] See page 5 of the December 20, 2006 Office Action.

the matrix adjacent a corresponding side of the tube," as recited in independent claim 31. Specifically, FIG. 20 of Orii does not teach two single part-length rods and two pairs of part-length rods along the sides of the tube, but rather, Orii teaches four pairs of part-length rods along the sides of the tube. Furthermore, FIG. 20 does not teach two pair of part-length rods each located near a corner of the water passage, but rather Orii teaches 4 separate part-length rods located equidistant along the 4 sides of the water passage. As stated explicitly in col. 15, lines 23-34, Orii arrives at the specifically derived part-length rod orientation of FIG. 20 (Orii explains in col. 15, lines 23-34 that this orientation is similar to the embodiment of FIG. 18) only by meeting the conditions of Equation 1, 4, 8, 10, 16 and 17 (see discussion in col. 14, lines 18-52, relating to FIG. 18). Therefore, Orii is not suggesting that the use of part-length rods is open to free movement of the part-length rod locations (or the addition or subtraction of part-length rods, generally), but rather, Orii is teaching the specific placement of these part-length rods as depicted in FIG. 18 and FIG. 20, based on the conditional Equations being met. Furthermore, Orii's main focus is to increase burn-up without increasing pressure drop, and therefore Orii does not teach or suggest the use of part-length rods to increase shut-down margin, for at least the reasons stated above related to claim 24.

The Examiner's suggested combination of Johansson with Orii would violate the conditional Equations of Orii. As such, combining Johansson with Orii would destroy Orii for its intended purpose. As discussed above with respect to claim 24, this is an impermissible and non-obvious combination. Claim 31, therefore, cannot be rendered obvious to a person of ordinary skill in the art by combining Orii in view of Johansson.

For at least the reasons stated above related to independent claim 31, Appellant asserts that this claim is patentable. Due at least to the dependence of claims 32 and 33 on claim 31, Appellant also asserts that claims 32 and 33 are patentable. Therefore, Appellant respectfully requests that the Board reverse the Examiner's rejection of these claims.

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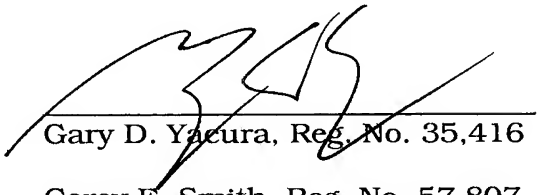
VIII. CONCLUSION

Appellant respectfully requests the Board to reverse the Examiner's rejection of claims 24, 26-29 and 31-33 and allow each of these claims.

The Commissioner is authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 08-0750 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17; particularly, extension of time fees.

Respectfully submitted,

HARNESS, DICKEY, & PIERCE, P.L.C.

By: 

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IX. CLAIMS APPENDIX:

24. (Previously Presented) A fuel bundle for a boiling water reactor, comprising:

a generally square, hollow tube having four sides which are configured as sides of the bundle,

a pair of circular-shaped water passages located adjacent to a longitudinal centerline of the tube so as to extend centrally through the tube, the pair of water passages supported by one or more rod supports,

a plurality of fuel rods arranged in a 10x10 matrix and including full-length rods and part-length rods, the part-length rods further comprising:

a first part-length rod group including two subsets in a mirror-image relationship along the centerline between the two water passages, each subset further comprising three part-length fuel rods in a triangular orientation with one rod of the subset closer to the longitudinal centerline between the two water passages than the other two rods of the subset and directly adjacent to the other two rods of the subset, and

a second part-length rod group including four pairs of part-length rods, each part-length rod pair centrally located in the outermost row or column of the 10x10 matrix adjacent a corresponding one of the four sides of the tube.

26. (Previously Presented) The fuel bundle of claim 24, wherein a plurality of voids are formed above upper ends of each of the part-length fuel rods to the top of the fuel bundle, and wherein the voids filled with water are configured to trap neutrons for improving a shutdown margin for the boiling water reactor.

27. (Previously Presented) The fuel bundle of claim 24, wherein there are a total of 14 part-length rods therein.

28. (Previously Presented) A fuel bundle for a boiling water reactor, comprising:

a pair of centrally located, circular-shaped water passages arranged on either side of a longitudinal centerline of the bundle within a 10X10 fuel-rod matrix bounded by four sides of a generally square, hollow tube, the fuel rods including full-length and part-length fuel rods,

wherein the 10X10 fuel-rod matrix includes two 3-rod subsets consisting of part-length rods in a mirror image relationship with one another along the longitudinal centerline between the two water passages, each 3-rod subset configured in a triangular orientation and directly adjacent to the pair of water passages such that one rod of the 3-rod subset is closer to the centerline than the other two rods and directly adjacent to the other two rods, and comprising eight additional part-length rods arranged in four pairs, each pair centrally located on an outermost row or column of the matrix nearest a corresponding one of the tube sides.

29. (Previously Presented) The fuel bundle of claim 28, wherein a plurality of voids are formed above upper ends of each of the part-length fuel rods to the top of the fuel bundle, and wherein the voids filled with water are configured to trap neutrons for improving a shutdown margin for the boiling water reactor.

31. (Previously Presented) A fuel bundle for a boiling water reactor, comprising:

a single, square-shaped water passage located off-center within a 10x10 fuel-rod matrix bounded by four sides of a generally square, hollow tube, the fuel rods including full-length and part-length fuel rods,

wherein the 10X10 fuel-rod matrix includes a first rod group comprising two pairs of part-length rods arranged on either side of a corner of the square water-passage, and a second rod group comprising two pairs of part-length rods and at least two non-paired part-length rods, each of the two pairs and the at least two non-paired part-length rods located in a corresponding outermost row or column of the matrix adjacent a corresponding side of the tube.

32. (Previously Presented) The fuel bundle of claim 31, wherein a plurality of voids are formed above upper ends of each of the part-length fuel rods to the top of the fuel bundle, and wherein the voids filled with water are configured to trap neutrons for improving a shutdown margin for the boiling water reactor.

33. (Previously Presented) The fuel bundle of claim 31, wherein there are a total of eleven part-length rods within the 10X10 matrix.

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X. EVIDENCE APPENDIX:

Pursuant to 37 C.F.R. §41.37(c)(1)(ix), Appellant provides the Board with a copy of the Board of Patent Appeals and Interferences Decision, decided March 31, 2008, on behalf of related application 10/748,175.

XI. RELATED PROCEEDINGS APPENDIX:

Pursuant to 37 C.F.R. §41.37(c)(1)(ix), Appellant provides the Board with a copy of the Board of Patent Appeals and Interferences Decision, decided March 31, 2008, on behalf of related application 10/748,175.

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10/748,175	12/31/2003	Lukas Trosman	24GA127098	5553

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EXAMINER	
PALABRICA, RICARDO J	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

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Action Due Date 5/31/08 Final Date
Action Mag Re-Hearing
Atty CDY/RCH DKT/Verify RC

PTOL-90A (Rev. 04/07)

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte LUKAS TROSMAN, CARY L. KUNZ, RUSSELL E. STACHOWSKI, RUSSELL M. FAWCETT, SHINGO FUJIMAKI, and DAISUKE GOTO

Appeal 2007-2607
Application 10/748,175
Technology Center 3600

Decided: March 31, 2008

Before TERRY J. OWENS, JENNIFER D. BAHR, and DAVID B. WALKER, *Administrative Patent Judges*.

WALKER, Administrative Patent Judge.

DECISION ON APPEAL

STATEMENT OF THE CASE

Appellants seek our review under 35 U.S.C. § 134 of the Examiner's final rejection of claims 21-26 and 28-32. We have jurisdiction under 35 U.S.C. § 6(b) (2002). We affirm.

Appellants claim an apparatus and method for disposing varying length fuel rods in a fuel channel assembly (Specification 1:[0002]). Claim 21, reproduced below, is representative of the subject matter on appeal.

> 21. A fuel bundle for a boiling water reactor, comprising:
>
> a generally square, hollow tube having four sides which are configured as sides of the bundle,
>
> a pair of water passages located adjacent to a longitudinal centerline of the tube so as to extend centrally through the tube, the pair of water passages supported by one or more rod supports,
>
> a plurality of fuel rods arranged in a 10 x 10 or 9 x 9 matrix and including full-length rods and part-length rods, the part-length rods further comprising:
>
> a first part-length rod group including two short-length fuel rod subsets in a mirror-image along the centerline between the two water passages, each subset further comprising three short-length fuel rods in a triangular orientation with one rod of the subset closer to the longitudinal centerline between the two water passages than the other two rods, the one rod in direct adjacent relation to the other two rods of the subset, and
>
> a second part-length rod group including four pairs of intermediate-length rods, each intermediate-length rod pair centrally located in the outermost row or

column of the 10 x 10 or 9 x 9 matrix adjacent a corresponding one of the four sides of the tube.

THE REJECTIONS

The Examiner relies upon the following as evidence in support of the rejections:

Ueda	US 5,068,082	Nov. 26, 1991
Johansson	US 5,229,068	Jul. 20, 1993
Orii	US 6,735,267 B2	May 11, 2004

Claims 21-26 and 28-32 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Orii in view of Ueda and Johansson.

ISSUE

The issue before us is whether Appellants have shown that the Examiner erred in rejecting claims 21-26 and 28-32 under 35 U.S.C. § 103(a) as unpatentable over Orii in view of Ueda and Johansson. The dispositive issue is whether it would have been obvious to one of skill in the art to modify the fuel assembly of Orii with the intermediate and short part-length rods of Ueda as required by the appealed claims in view of the teachings of Johansson of the advantages of using part-length rods.

Rather than repeat the arguments of Appellants and the Examiner, we make reference to the Brief and the Answer for their respective details. Only those arguments actually made by Appellants have been considered in

this decision. Arguments which Appellants could have made but chose not to make in the Brief have not been considered and are deemed to be waived. *See* 37 C.F.R. § 41.37(c)(1)(vii) (2004).

FINDINGS OF FACT

We find the following enumerated findings to be supported by at least a preponderance of the evidence. *Ethicon, Inc. v. Quigg*, 849 F.2d 1422, 1427 (Fed. Cir. 1988) (explaining the general evidentiary standard for proceedings before the Office).

1. There is no dispute that Orii teaches all of the limitations of claim 21, except for differentiating between short- and intermediate-length, part-length rods and including two part-length fuel rod subsets in a mirror-image along the centerline between the two water passages, each subset further comprising three short-length fuel rods in a triangular orientation with one rod of the subset closer to the longitudinal centerline between the two water passages than the other two rods, the one rod in direct adjacent relation to the other two rods of the subset (Answer, 3, Br. *passim*, Reply Br. *passim*).
2. Orii shows a reactor core design in Figure 15 with two part-length fuel rod subsets in a mirror-image along the centerline between the two water passages, but the subsets each comprise two rather than the claimed three part-length rods (Orii, Figure 15). Urii also shows four pairs of part-length rods, each rod pair centrally located

in the outermost row or column of the 10 x 10 matrix adjacent a corresponding one of the four sides of the tube, but does not specify that the rods are of intermediate length (relatively longer than the part-length rods specified in the two subsets adjacent to the water passage described above) (Orii, Figure 15, col. 12, l. 54 – col. 13, l. 39).

3. Ueda teaches sixty –six different embodiments of fuel assemblies for boiling water nuclear reactors, which include varied arrangements of part-length fuel rods in 8 x 8, 9 x 9, 10 x 10, and 11 x 11 fuel rod matrices. For example, Ueda shows using three-rod subgroups adjacent to a water passage (Ueda, Figure 19), and teaches that using four such subgroups around a water passage increases the effective multiplication factor at the high temperature operation period and reduces the effective multiplication factor at the low temperature operation period to provide a large shutdown margin (Ueda, col. 12, ll. 53-66).
4. Ueda teaches the use of two types of part-length rods of different axial length (e.g. short- and intermediate-length rods) and discloses locating the short-length rods at the inner corner portions of subbundles near a water channel and the intermediate-length rods extending outward from a central water channel towards the sides of the tube. The intermediate-length rods are located further

outward from center of the rod assembly than the short-length rods (Ueda, col. 14, l. 41- col. 15, l. 8; Figs. 25A-D).

5. Ueda teaches the use of four single part-length rods, each at the center of a respective side of a 10 x 10 fuel matrix (Ueda, Fig. 27).
6. Johansson teaches numerous advantages resulting from the part-length rod construction, including improved cold shut down margin that enables fuel to be designed with reduced amounts of burnable absorbers, reduced tendency of the fuel bundle in the reactor to produce plutonium at the top of the bundle, and reduced pressure drop in the upper two phase region of the fuel bundle (Johansson, col. 2, ll. 3-15).

PRINCIPLES OF LAW

"Section 103 forbids issuance of a patent when 'the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.'" *KSR Int'l Co. v. Teleflex Inc.*, 127 S.Ct. 1727, 1734 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including (1) the scope and content of the prior art, (2) any differences between the claimed subject matter and the prior art, (3) the level of ordinary skill in the art, and (4) where in evidence, so-called secondary considerations. *Graham v. John Deere Co.*, 383 U.S. 1,

17-18 (1966). *See also KSR*, 127 S.Ct. at 1734 ("While the sequence of these questions might be reordered in any particular case, the [*Graham*] factors continue to define the inquiry that controls.")

In rejecting claims under 35 U.S.C. § 103(a), the examiner bears the initial burden of establishing a prima facie case of obviousness. *In re Oetiker*, 977 F.2d 1443, 1445 (Fed. Cir. 1992). *See also In re Piasecki*, 745 F.2d 1468, 1472 (Fed. Cir. 1984). Only if this initial burden is met does the burden of coming forward with evidence or argument shift to the appellant. *Id.* at 1445. *See also Piasecki*, 745 F.2d at 1472. Obviousness is then determined on the basis of the evidence as a whole and the relative persuasiveness of the arguments. *See Oetiker*, 977 F.2d at 1445; *Piasecki*, 745 F.2d at 1472.

ANALYSIS

Appellants argue claims 21, 22, 29, and 31 as a group. We consider claim 21 above to be representative.

Appellants argue that Orii, singly or in combination with Ueda, does not teach 1) two short-length fuel rod subsets, each comprising three short-length rods in a triangular orientation with one rod of the subset closer to the longitudinal centerline between the two water passages than the other two rods; 2) a second part-length rod group including four pairs of intermediate-length rods as required by independent claim 21; and 3) a 10 x 10 fuel–rod matrix including full-length, intermediate-length, and short-length fuel rods

as required by claims 21, 29, and 31 (Br. 5-6). The Examiner found that there is no distinction between Orii and the appealed claims except that Orii does not distinguish between short- and intermediate-length rods, and the subsets of rods in a mirror image along the center line are in pairs rather than the triplets required by the appealed claims (Answer 3). We agree (Findings of Fact 1 & 2).

The Examiner relied on Ueda for its teaching 1) to provide 3-rod part-length subsets adjacent to a water passage; and 2) to place relatively shorter part-length rods closer to the center of the fuel bundle and relatively longer part-length rods towards the periphery of the fuel bundle (Answer 4 referring to Ueda, Figures 19 and 25B). The Examiner found that Johansson teaches that the addition of part-length rods lowers the pressure drop, thereby improving critical power, and improves shutdown margin (Answer 4, citing Johansson, col. 2, ll. 3-15).

Appellants further argue that it would not have been obvious and would not have made sense to combine Ueda's 8 x 8 matrix of Figure 19 or 9 x 9 matrix of Figure 25 with Orii's 10 X 10 matrix in Figure 15, because the references have completely different fuel rod arrangements, water passage configurations, and Ueda teaches four sets of short-length rods around each adjacent edge of the water channel. We do not find this argument persuasive because Ueda teaches sixty-six different embodiments of fuel assembly with a variety of configurations of part –length rods in 8 x 8, 9 x 9, 10 x 10, and 11 x 11 fuel rod matrices without limiting its teachings

of the advantages of part-length rods to a particular fuel rod matrix configuration (Finding of Fact 3). Moreover, the Examiner does not seek to bodily incorporate the Figure 19 or Figure 25 embodiments of Ueda into Orii, but rather relies on Ueda only for its teaching 1) to provide 3-rod subsets adjacent to a water passage; and 2) to place relatively short part-length rods closer to the center of the fuel bundle and relatively longer part-length rods towards the periphery of the fuel bundle (Answer 4). Appellant's argument appears to attack Orii and Ueda individually, rather than the combination of Ueda and Johansson with Orii proposed by the Examiner. Nonobviousness cannot be established by attacking the references individually when the rejection is predicated upon a combination of prior art disclosures. *See In re Merck & Co. Inc.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986).

Appellants further argue that there is no teaching, suggestion, or motivation to combine Orii and Ueda based on the differences between the specific embodiments cited by the Examiner. The Appellants assert that the teaching of Johansson that the use of part-length rods lowers pressure drops, and hence may improve critical power would not provide motivation to combine because Orii and Ueda already employ part-length rods (Br. 13).

The Examiner found that the proposed modification of Orii is replacing two full length rods with two part-length rods to convert the two 2-rod subgroups of Orii to the two 3-rod subgroups as shown in Ueda and as required by the appealed claims, which the Examiner found to be within the

purview of the skill artisan and within the teachings of the cited art (Answer 7). The Examiner relied upon Johansson for its teachings of the benefits of part-length rods, particularly improving critical power. The Examiner also found the objects of increasing fuel utilization without increasing pressure loss taught in Orii and maintaining shutdown margin or improving axial power distribution as taught by Ueda to be closely related to each other and to optimizing reactor power.

While there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness, "the analysis need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ." *KSR*, 127 S.Ct. at 1741.

> When there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has good reason to pursue the known options within his or her technical grasp. If this leads to the anticipated success, it is likely the product not of innovation but of ordinary skill and common sense. In that instance the fact that a combination was obvious to try might show that it was obvious under § 103.

Id. at 1742. In this instance, there are a finite number of identified, predictable possibilities with regard to the arrangement of intermediate- and short-length rods in a reactor fuel assembly. Ueda shows sixty-six such

possibilities (Finding of Fact 3), and the Examiner's proposed combination is nothing more than another identified, predictable solution, combining the elements of Orii and Ueda.

In *KSR*, the Supreme Court emphasized that "[t]he combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results." *Id.* The Court explained:

> When a work is available in one field of endeavor, design incentives and other market forces can prompt variations of it, either in the same field or a different one. If a person of ordinary skill can implement a predictable variation, §103 likely bars its patentability. For the same reason, if a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill.

Id. at 1740. The operative question in this "functional approach" is thus "whether the improvement is more than the predictable use of prior art elements according to their established functions." *Id.*

In this case, replacing two full length rods with two part-length rods to convert the two 2-rod subgroups of Orii to the two 3-rod subgroups as shown in Ueda and making the two 3-rod subgroups of relatively shorter part-length rods that the four pairs of outer part-length rods as suggested by Ueda is no more than the combination of familiar elements according to

known methods, which is likely to be obvious where, as here, it does no more than yield predictable results. *KSR*, 127 S.Ct. at 1734.

Neither Appellants' Specification nor Appellants' arguments present any evidence that converting the two 2-rod subgroups of Orii to the two 3-rod subgroups as shown in Ueda and making the two 3-rod subgroups of relatively shorter part-length rods that the four pairs of outer part-length rods as suggested by the Examiner would have been uniquely challenging or difficult for one of ordinary skill in the art. Under those circumstances, the Examiner did not err in holding that it would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the aforementioned teachings in order to provide the benefits that are the disclosed objects of all of the referenced prior art, particularly an improved shutdown margin (Answer 5). Because this is a case where the improvement is no more than the predictable use of prior art elements according to their established functions, no further analysis was required by the Examiner. *KSR*, 127 S.Ct. at 1740.

The Appellants have failed to show error in the Examiner's rejection of claim 21. Claims 22, 29, and 31 were not argued separately, and fall with claim 21. The Appellants make no arguments as to claims 25 and 28. Claims 25 and 28 therefore fall with claim 21, as they were not argued separately. See 37 C.F.R. § 41.37(c)(1)(vii). *See also In re Young*, 927 F.2d 588, 590 (Fed. Cir. 1991).

The Appellants separately argue the patentability of claims 23, 24, 26, 30, and 32. The Appellants argue that the Examiner has not shown where the lengths of short- and intermediate-length rods relative to the full–length rods as required by claims 23, 24, and 26 is taught (Br. 14). The Examiner found that the number and relative length of part-length rods is a matter of optimization within prior art conditions or through routine experimentation (Answer 5). In particular, the Examiner found that the Appellants have not shown the criticality of the claimed rod length ranges or arrangements, and indeed there is none, as the claimed rod length ranges and number of partial-length rods achieve only predictable and expected changes in reactor performance (Answer 14-15). The Examiner is correct that the Appellants have provided evidence of neither criticality nor unexpected results. The Appellants thus have failed to show error in the Examiner's rejection of claims 23, 24, and 26.

With respect to claim 30, the Appellants argue that the Examiner has not shown where the references teach a 10 x 10 fuel-rod matrix with the claimed arrangement of intermediate length rods. We do not find this persuasive because Orii teaches the claimed arrangement of four-pairs of part-length rods (Finding of Fact 1-2), and Ueda teaches the use of intermediate-length, part-length rods along the sides of a reactor fuel assembly (Finding of Fact 4). As discussed above, we find the Appellants' arguments against the combination of Orii and Ueda unpersuasive; the Appellants have failed to show error in the Examiner's rejection of claim 30.

With respect to claim 32, the Appellants argue that the Examiner has not shown where the references teach a 9 x 9 fuel-rod matrix with six rather than eight intermediate-length rods in a different arrangement (two pairs and two unpaired single rods). The cited references do not explicitly teach this arrangement of intermediate rods, but the Examiner found that the Appellants have not shown the criticality of particular number of part-length rods and that the number of partial-length rods achieve only predictable and expected changes in reactor performance (Answer 14-15). Moreover, Ueda does teach the placement of a single part-length rod at the center of each of the sides of a fuel assembly (Finding of Fact 5).

In this case, replacing two intermediate-length rods with two full length-length rods to convert the two of the pairs of intermediate-length rods taught by Orii into two unpaired intermediate-length rods as shown in Ueda is no more than the combination of familiar elements according to known methods, which is likely to be obvious where, as here, it does no more than yield predictable results. *KSR*, 127 S.Ct. at 1734. Neither Appellants' Specification nor Appellants' arguments present any evidence that converting two of the pairs of intermediate-length rods taught by Orii into two unpaired intermediate-length rods would have been uniquely challenging or difficult for one of ordinary skill in the art. The Appellants have failed to show error in the Examiner's rejection of claim 32.

CONCLUSIONS

We conclude that Appellants have not shown that the Examiner erred in rejecting claims 21-26 and 28-32 under 35 U.S.C. § 103(a).

DECISION

The decision of the Examiner to reject claims 21-26 and 28-32 under 35 U.S.C. § 103(a) is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a). *See* 37 C.F.R. § 1.136(a)(1)(iv) (2006).

AFFIRMED

vsh

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